CENTRIFUGAL AIR BLOWER

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a centrifugal air blower, and more particularly to a centrifugal air blower for use in an air-conditioning system in a vehicle.

Description of the Related Art:

One conventional centrifugal air blower is illustrated in FIGS. 5 and 6 of the accompanying drawings. The conventional centrifugal air blower 1 in FIGS. 5 and 6, has a fan 3 rotatable by a motor 2 and a scroll casing 5 having a spirally shaped first discharge passage 4 extending around the fan 3 for forcing air into the passenger's compartment of a vehicle, for example, upon rotation of the fan 3. The scroll casing 5 comprises a main case 5a housing the motor 2 and the fan 3 therein, and an extended case 5b attached to the main case 5a.

The motor 2 is fixedly mounted on the main case 5a so as to extend through a lower wall of the main case 5a. The fan 3 is mounted on the rotatable shaft of the motor 2 and is accommodated substantially centrally in the main case 5a. The fan 3 comprises a plurality of blades 6 spaced at equal angular intervals around the circumference thereof, an annular holder ring 7a mounted on the upper ends of the blades 6, and a bottom plate 7b mounted on the lower ends of the blades 6.

The main case 5a comprises an upper plate 9 disposed above the fan 3 and having an air inlet 8 defined therein over the fan 3, a lower plate 10 disposed beneath the fan 3 vertically facing the upper panel 9, and an arcuate outer wall 11 joining the circumferential edges of the upper and lower plates 9, 10. As shown in FIG. 5, of the main case 5a, the cross-sectional area near a terminal position N of the first discharge passage 4 progressively increases toward the outlet, and the distance from the center of the fan 3 to the outer circumferential edge of the first discharge passage 4 progressively increases toward the outlet of the first discharge passage 4. The lower plate 10 comprises an annular panel 12 positioned near the bottom plate 7b, a spiral flat panel 13 disposed substantially perpendicularly to the outer wall 11, and a spiral joint panel 14 slanted downwardly from the annular panel 12 toward the outward direction of the fan 3.

The extended case 5b has a second discharge passage 15 defined therein which communicates with the outlet of the first discharge passage 4. The cross-sectional area of the second discharge passage 15 progressively increases toward its outlet from the outlet of the first discharge passage 4.

For reducing the overall size of the conventional centrifugal air blower 1, the second discharge passage 15 in the extended case 5b, for example, is vertically increased therefore allowing the scroll casing 5 to be compact. In this case, the vertical size of the second discharge passage

15 is increased from a position of the outer and inner walls, which can be connected by a line, i.e., from a position X of the outer wall and a position Y of the inner wall. Thus, the four sides of the vertical cross section of the second discharge passage 15 are formed with lines.

As shown in FIGS. 5 and 6 of the accompanying drawings, the extended case 5b defining the second discharge passage 15 therein, has an extended upper panel 16 which progressively spreads upwardly at an angle θ_{UP} from a position near a terminal position N of the spirally shaped main case 5a, and an extended lower panel 17 which progressively spreads downwardly at an angle θ_{LR} from an end portion of the shaft of the motor 2. The highest end of the extended upper panel 16 is higher that the upper panel 9 by a distance H_{UP}, and the lowest end of the extended lower panel 17 is lower than the annular panel 12 of the lower plate 10 by a distance H_{LR} .

If the ratio H_{UP}/H_{LR} of the distance H_{UP}, which is the distance from the outer end of the extended upper panel 16 and the upper panel 9, and the distance H_{LR}, which is the distance from the outer end of the extended lower panel 17 to the annular panel 12 of the lower plate 10, is large, then swirling flows 18, 19 (see FIG. 6) are generated near the position X where vertical size of the outer wall starts to increase and near the position Y where vertical size of the inner wall starts to increase, causing an energy loss of the air that flows through the first and second discharge

passages 4, 15. As a result, a large pressure loss may occur in the conventional centrifugal air blower 1, and the conventional centrifugal air blower 1 tends to produce large noise.

If the positions X, Y are displaced upstream of the first discharge passage 4, then the angle θ_{LR}, by which the extended lower panel 17 is progressively spread downwardly, is reduced, possibly reducing the swirling flows 18, 19 produced at the positions X, Y. However, since the vertical positional difference between the bottom plate 7b of the fan 3 and the flat panel 13 is increased, a swirling flow 20 is liable to be developed. Consequently, the amount of air discharged from the conventional centrifugal air blower 1 is reduced due to a pressure loss caused thereby, and increased noise is generated by the conventional centrifugal air blower 1.

SUMMARY OF THE INVENTION

It is a major object of the present invention to provide a centrifugal air blower which allows discharged air to flow smoothly and reduces swirling flows produced therein.

According to the present invention, a centrifugal air blower has an air guide means for guiding air in a discharge passage, the air guide means having an arcuately shaped surface extending along the discharge passage for allowing air to flow smoothly to reduce swirling flows in the air.

Pressure loss caused in the discharge passage and noise is greatly reduced.

Another object of the present invention is to provide a centrifugal air blower which includes an extended case having a discharge passage defined therein and having a cross-sectional area which progressively increases, and an air guide means disposed in the discharge passage for guiding air in a discharge passage. The air guide means has an arcuately shaped surface extending along the discharge passage.

Still another object of the present invention is to provide a centrifugal air blower which has an air guide means for guiding air, the air guide means having an edge at a position to start increasing the vertical size of an outer wall of an extended case and an opposite edge at a position to start increasing the vertical size of an inner wall of the extended case, the former position being positioned upstream of the latter position.

Yet another object of the present invention is to provide a centrifugal air blower which has an air guide means for guiding air, the air guide means having an arcuately shaped surface which has a radius of curvature near an outer wall of an extended case and a radius of curvature near an inner wall of the extended case, the former radius of curvature being greater than the latter radius of curvature.

The above and other objects, features, and advantages

of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which a preferred embodiment of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, partly cut away, of a centrifugal air blower according to an embodiment of the present invention;

FIG. 2 is a view showing the positional relationship between a discharge passage in a scroll casing and an air guide means;

FIG. 3 is a cross-sectional view taken along line III - III of FIG. 2;

FIG. 4 is a cross-sectional view taken along line IV - IV of FIG. 2;

FIG. 5 is a perspective view, partly cut away, of a conventional centrifugal air blower; and

FIG. 6 is a cross-sectional view of the conventional centrifugal air blower shown in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A centrifugal air blower according to a preferred embodiment of the present invention will be described in detail below with reference to FIGS. 1 through 4.

FIG. 1 shows in perspective, partly cut away, a centrifugal air blower 30 according to a preferred

embodiment of the present invention. Those parts of the centrifugal air blower 30, which are identical to those of the conventional centrifugal air blower shown in FIGS. 5 and 6, are designated by identical reference characters, and will not be described in detail below.

As shown in FIG. 1, the centrifugal air blower 30 has an air guide means 32 disposed in first and second discharge passages 4, 15 in a main case 5a and an extended case 5b. The air guide means 32 has an end starting from the first discharge passage 4 in the main case 5a. The air guide means 32 has a body integrally combined with an upper end surface of an extended lower panel 17, and essentially providing the second discharge passage 15 in the extended case 5b.

As shown in FIG. 2, the end of the air guide means 32 positioned upstream in the first discharge passage 4 has an edge at a position A to start increasing the vertical size of the outer wall and an opposite edge at a position B to start increasing the vertical size of the inner wall. The position A is positioned an angle θ upstream of the position B. The angle θ is formed between a straight line L1 which connects the center M of a motor 2 and the position B, and a straight line L2 which connects the center M of the motor 2 and the position A.

As shown in FIGS. 3 and 4, the air guide means 32 has an arcuate longitudinal section and includes an curved surface 34 near the outer wall and an curved surface 36 near

the inner wall, the curved surfaces 34, 36 have different radii R1, R2 of curvature, respectively. The position B is located downstream of the position A.

Specifically, ratios of the radius R1 of curvature of the curved surface 34 near the outer wall and the radius R2 of curvature of the curved surface 36 near the inner wall are set to values shown in Table 1 below. By setting the ratios, air flows smoothly in the first and second discharge passages 4, 15 which efficiently reduces pressure losses in the first and second discharge passages 4, 15 and noise produced by the centrifugal air blower 30.

Table 1

	R1 (mm)	R2 (mm)	R1/R2
(1)	600	190	3.15
(2)	720	230	3.13
(3)	610	210	2.90

In the centrifugal air blower 30, the position A on the end of the air guide means 32 is located upstream of the position B on the end of the air guide means 32, and the upper surface of the air guide means 32 is curved for reducing swirling flows in the air discharged from the fan 3 and the air flowing in the first and second discharge passages 4, 15.

In FIG. 3, it is assumed that a line V1 tangential to an end X1 of the curved surface 34 and a straight line W1,

which passes through the other end Y1 of the curved surface 34 and is perpendicular to the tangential line V1, intersect at a point Z1, and the other end Y1 is spaced from the point Z1 by a distance H1.

In FIG. 4, it is assumed that a line V2 tangential to an end X2 of the curved surface 36 and a straight line W2, which passes through the other end Y2 of the curved surface 36 and is perpendicular to the tangential line V2 intersect at a point Z2, and the other end Y2 is spaced from the point Z2 by a distance H2.

The distances H1, H2 are the same, and are determined by the area of an opening, which depends on the rate of air discharged through the second discharge passage 15 shown in FIG. 1. The arcuate shape of the air guide means 32 near the outer wall is set such that the radius R1 of curvature near the outer wall is greater than the radius R2 of curvature near the inner wall, so that the position A will not be displaced downstream.

As described above, the centrifugal air blower according to the present invention has the air guide means whose outer surface has an arcuate shape, which enables air to flow smoothly to reduce swirling flows therein. Therefore, pressure losses in the discharge passages and noise are greatly reduced.

In the illustrated embodiment, the air guide means 32 is integrally combined with the second discharge passage 15. However, the air guide means 32 may be separate from the

second discharge passage 15 and disposed within the second discharge passage 15.

In the illustrated embodiment, the air guide means 32 is disposed on the upper end surface of the extended lower panel 17, i.e., on the bottom surface of the second discharge passage 15. However, the air guide means 32 may be disposed on a lower end surface of the extended upper panel 16, i.e., on the ceiling surface of the second discharge passage 15, or may be disposed on both the upper end surface of the extended lower panel 17 and the lower end surface of the extended upper panel 16.

Further, the radii R1, R2 of curvature of the arcuately curved surfaces 34, 36 near the outer and inner walls may be the same.

Furthermore, the positions A, B at the opposite edges of the end of the air guide means 32 may be aligned for reducing swirling flows in the air flowing through the second discharge passage 15.

Although a certain preferred embodiment of the present invention has been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.